Homework2

Bin Packing problem

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Fitness:

for calculating fitness I read a paper. In that paper wrote the best formulation of fitness is: $\sum_{i=1}^{n} \left(\frac{f_i}{c}\right)^k$,

c = capacity of bin

k = 2 or 4

n = number of bin

fi = filled value of bin

Mutation:

I used 3 kind of mutation methods included (swap mutation, inversion mutation, insert mutation)

- **Swap mutation:** Pick two alleles at random and swap their positions then swap their places.
- **Insert mutation:** Pick two allele values at random, Move the second to follow the first, shifting the rest along to accommodate.
- **Inversion mutation:** pick two alleles at random and then invert the substring between them.

Crossover:

I used 2 kind of crossover methods included (order1crossover, cut and fill crossover)

- **1order crossover:** Copy randomly selected set from first parent . The segment between these two points from one parent is directly copied to the offspring
- **Cut and fill crossover:** A single crossover point is chosen within the parent permutations The first part of the first parent (up to the crossover point) is copied directly to the offspring The remaining positions in the offspring are filled using elements from the second parent, ensuring that no duplicates occur. This involves checking which elements from the second parent are not already present in the offspring before filling.

Parents selection:

to select an individual from a given population probabilistically, where individuals with higher fitness scores have a higher chance of being selected.

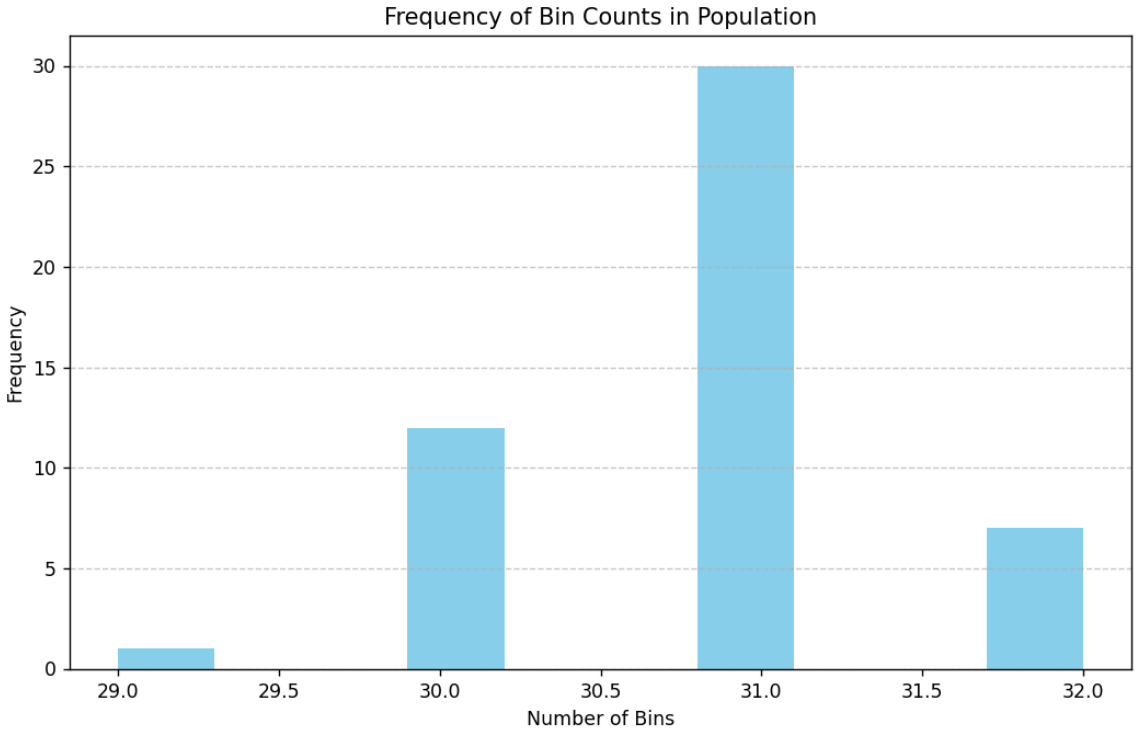
Elitism:

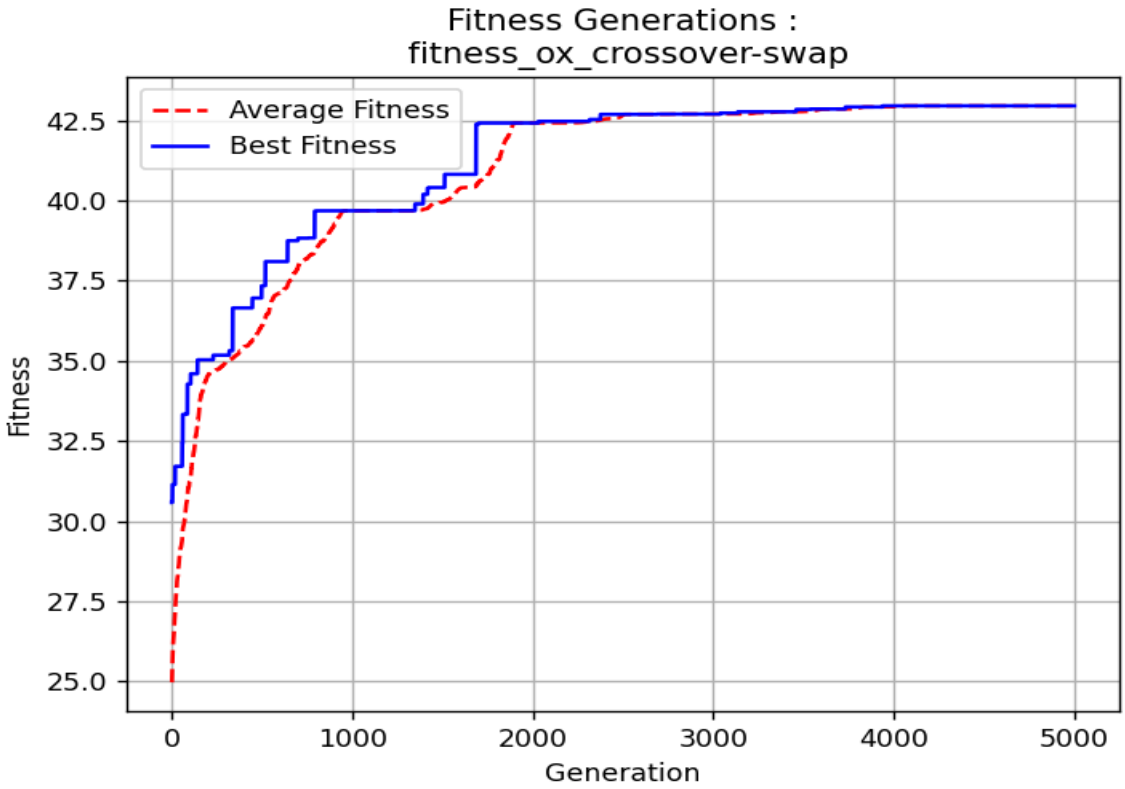
in this approach the population generate a new population then themselves removed.

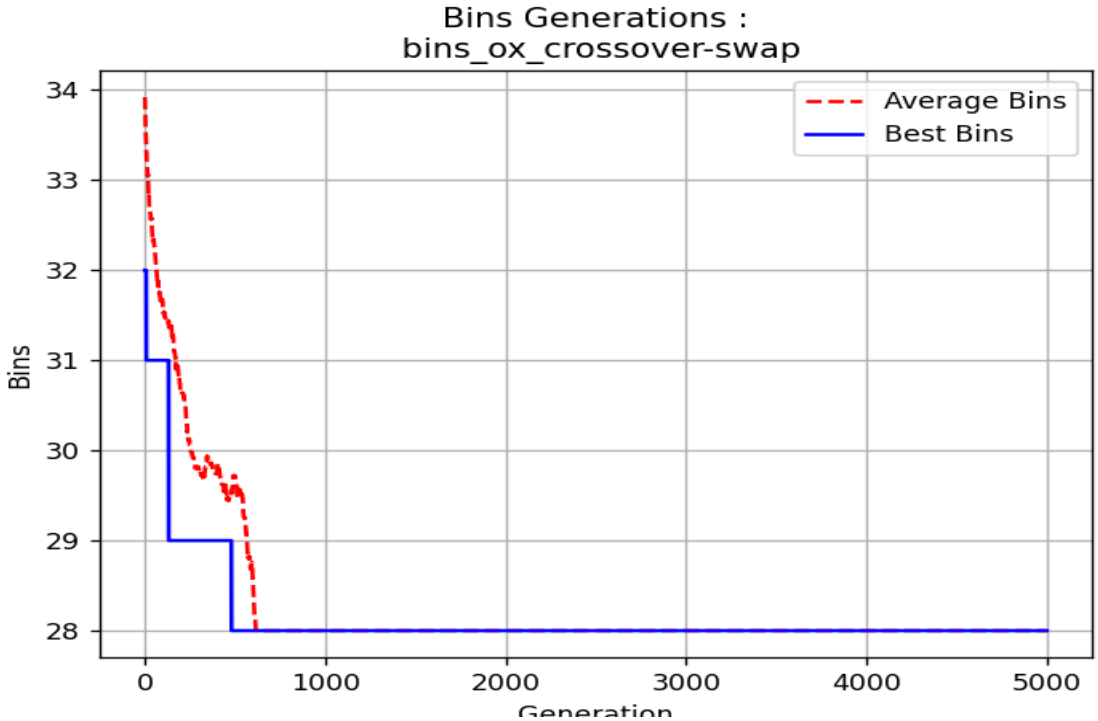
Representation:

In the context of the Bin Packing Problem (BPP-1D), permutation representation offers a streamlined and efficient approach to solving this complex optimization challenge. The BPP-1D involves packing a set of items, each with a specific size, into a finite number of bins with a fixed capacity, aiming to minimize the number of bins used.

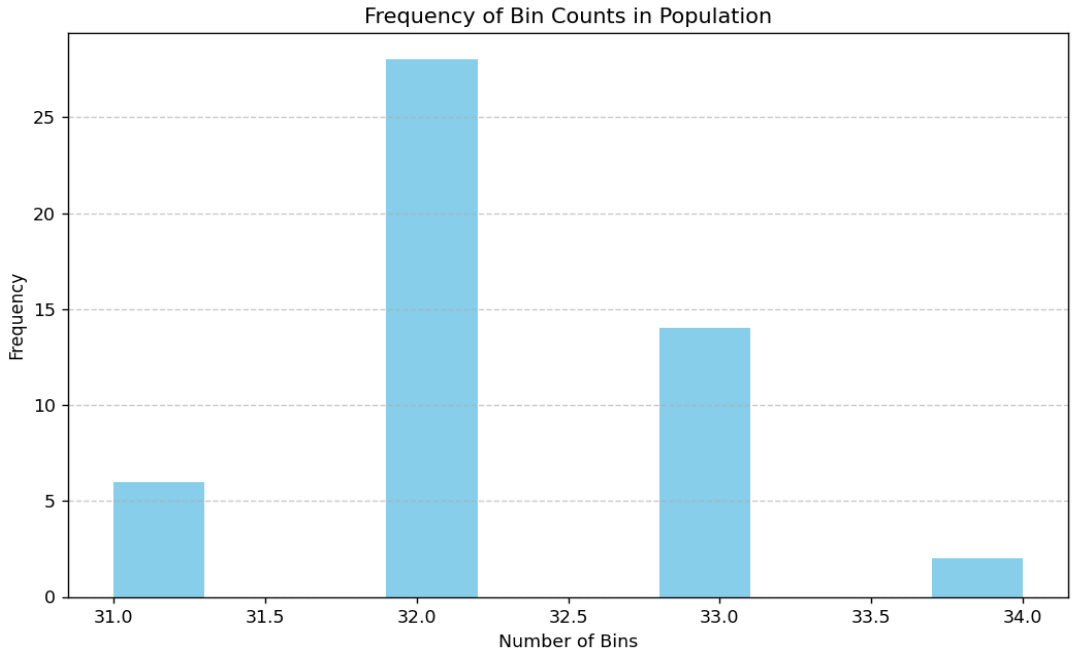
Instance 1 : ox crossover and swap mutation with max round 50

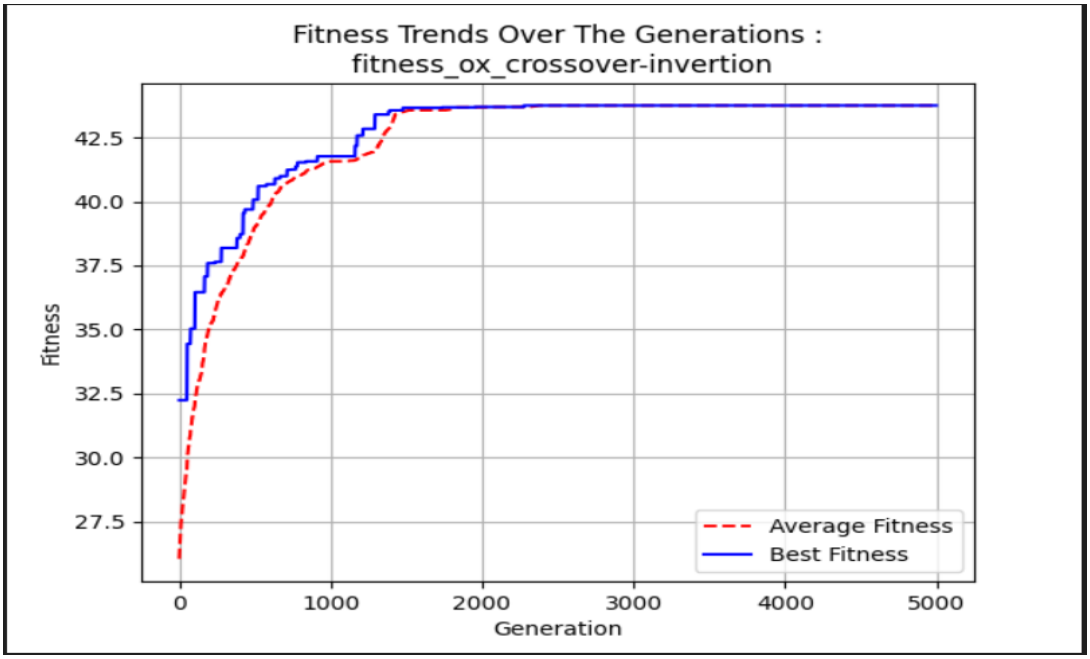


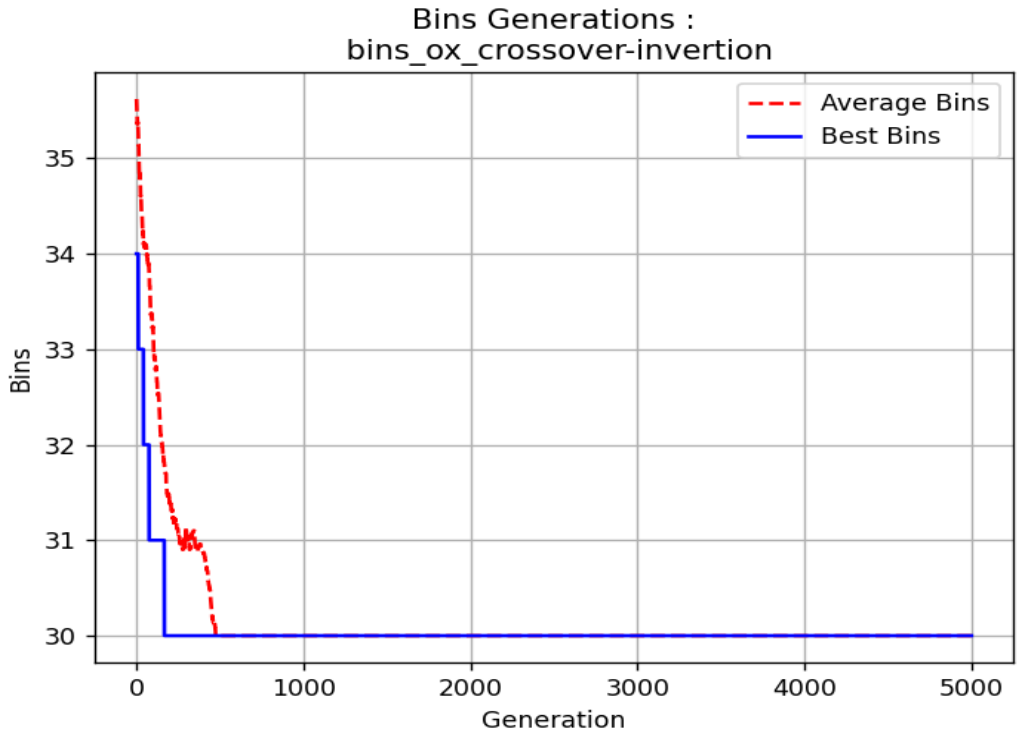

Fitness Generations :
fitness_ox_crossover-swap
Average Fitness
Best Fitness
Fitness
Generation
42.5
40.0
37.5
35.0
32.5
30.0
27.5
25.0
0
1000
2000
3000
4000
5000


Bins Generations :
bins_ox_crossover-swap
Average Bins
Best Bins
Bins
34
33
32
31
30
29
28
0
1000
2000
3000
4000
5000

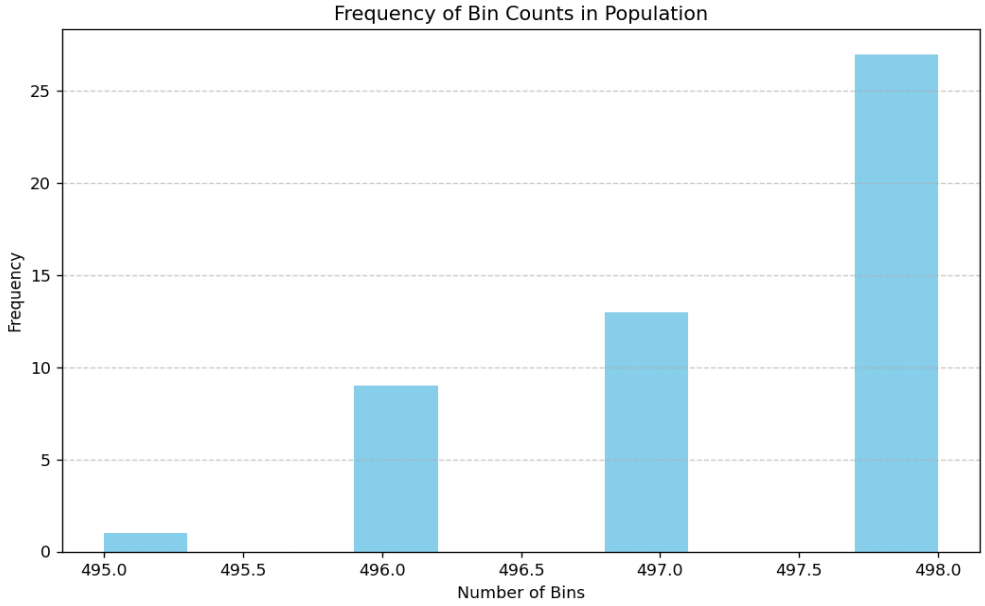
Instance 2: ox crossover and inversion mutation with max round 50

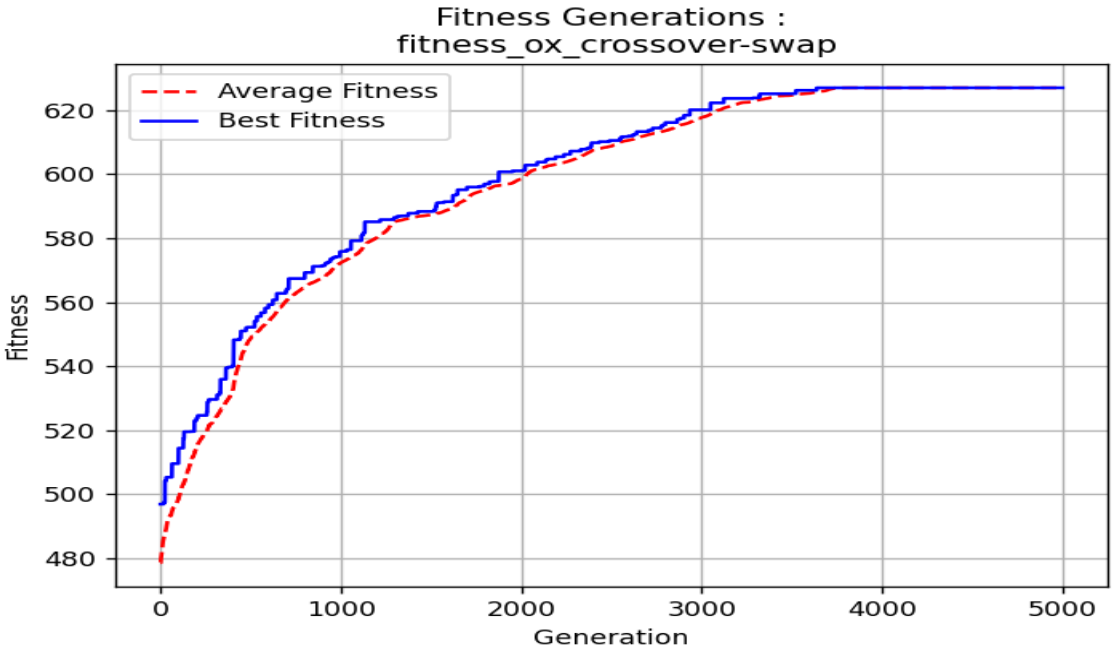


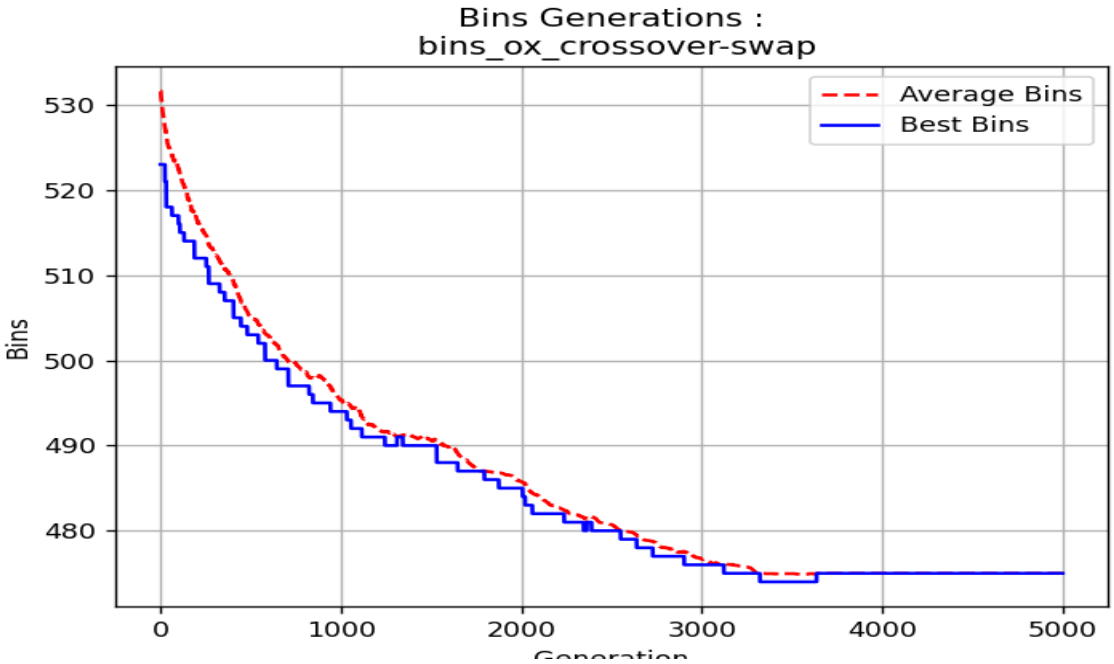



Bins Generations :
bins_ox_crossover-invertion
Average Bins
Best Bins
Bins
Generation
35
34
33
32
31
30
0
1000
2000
3000
4000
5000

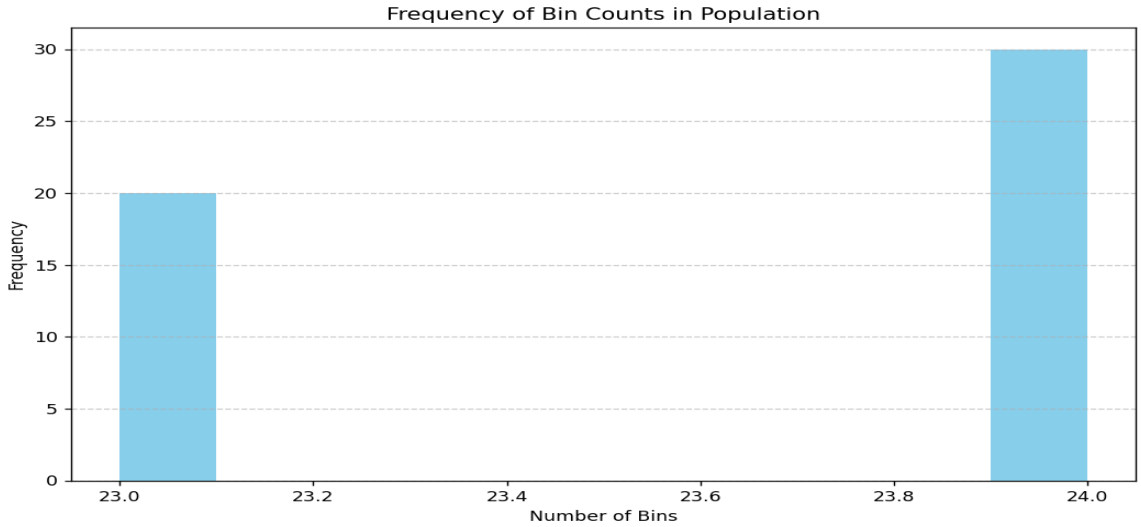
Instance3: ox crossover and inversion mutation and 1000 max round

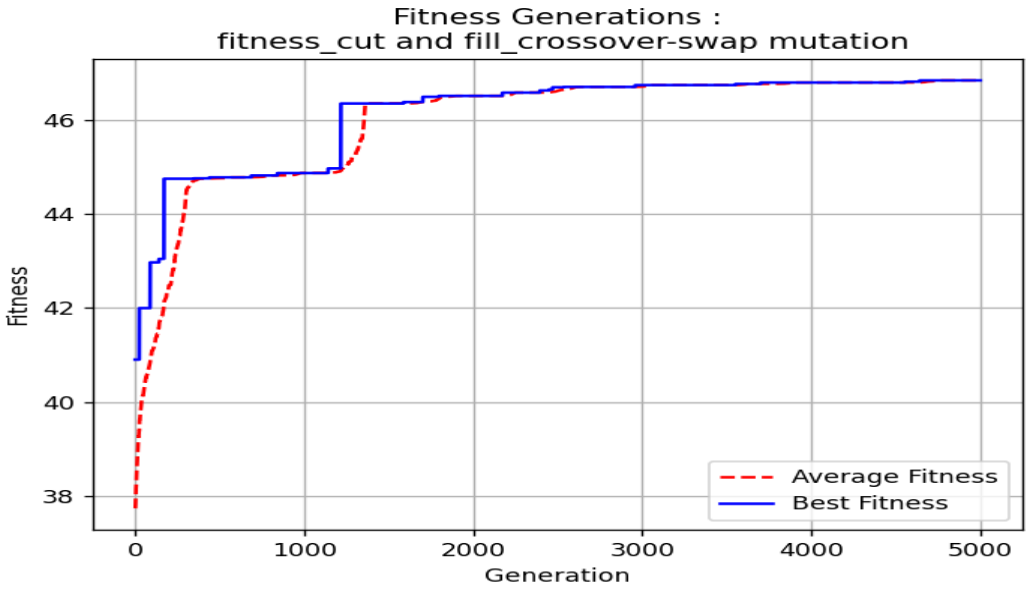


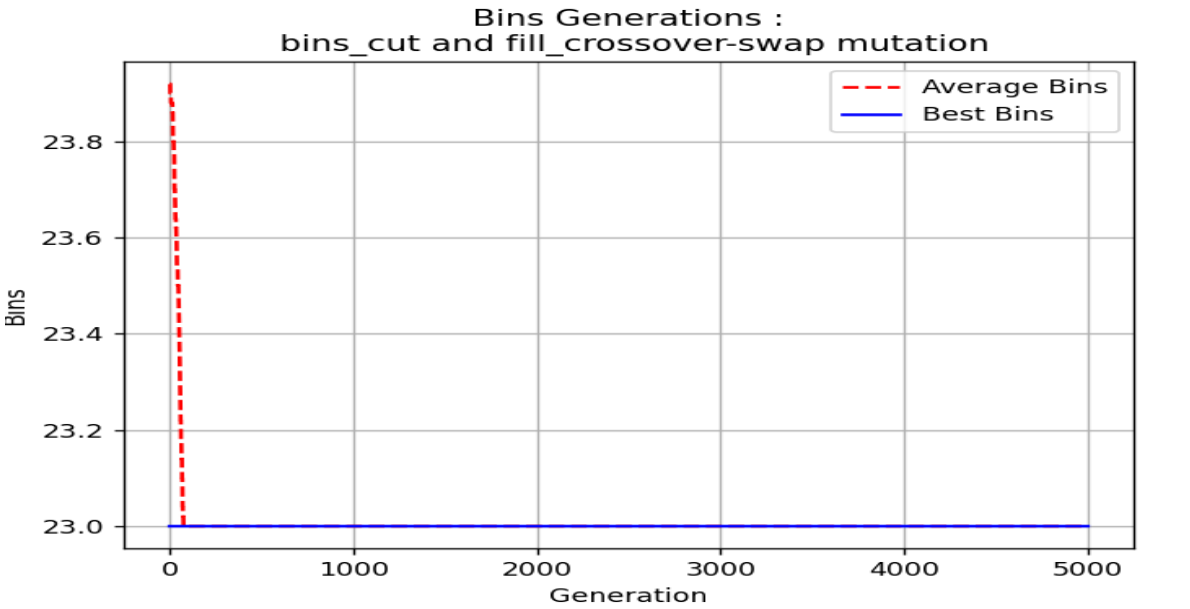



Bins Generations :
bins_ox_crossover-swap
Average Bins
Best Bins
Bins
530
520
510
500
490
480
0
1000
2000
3000
4000
5000

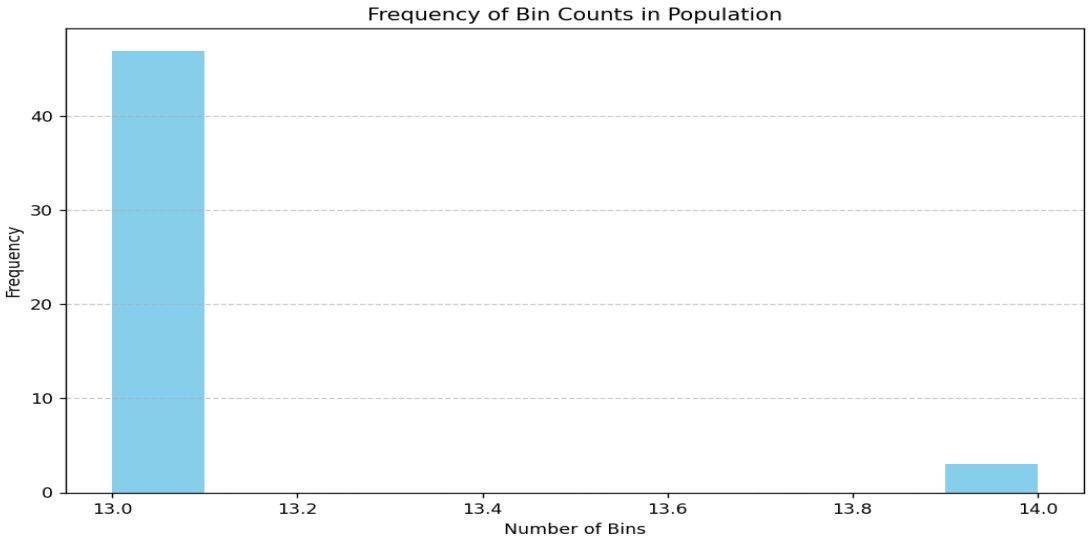
Instance 4: cut and fill crossover and swap mutation with 50 max round

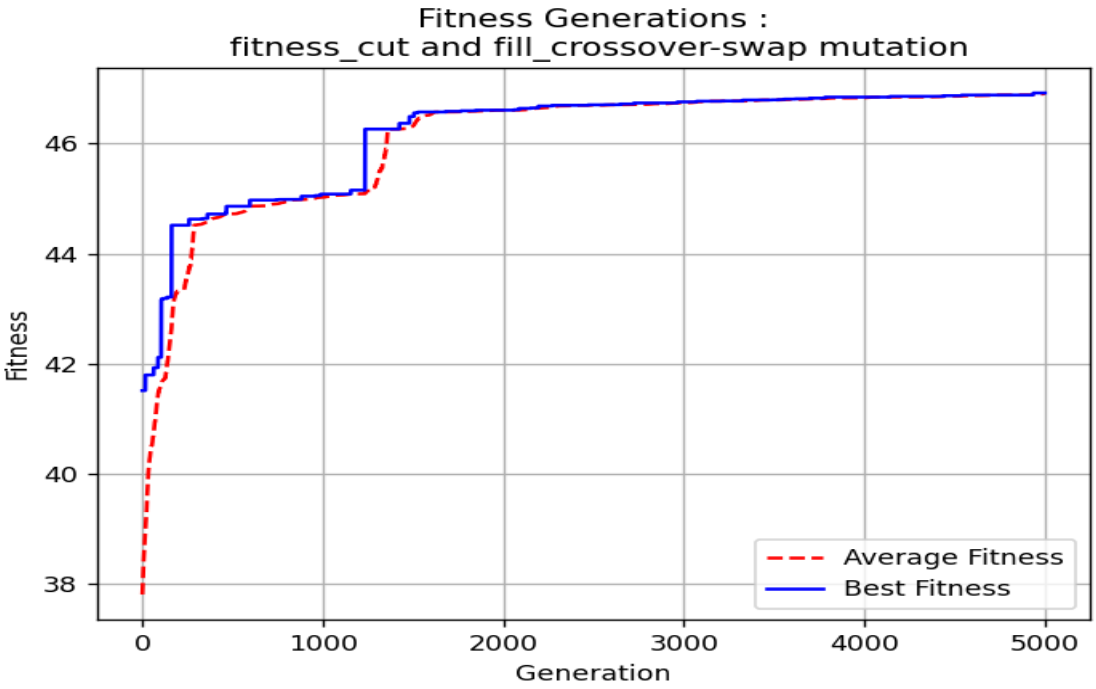


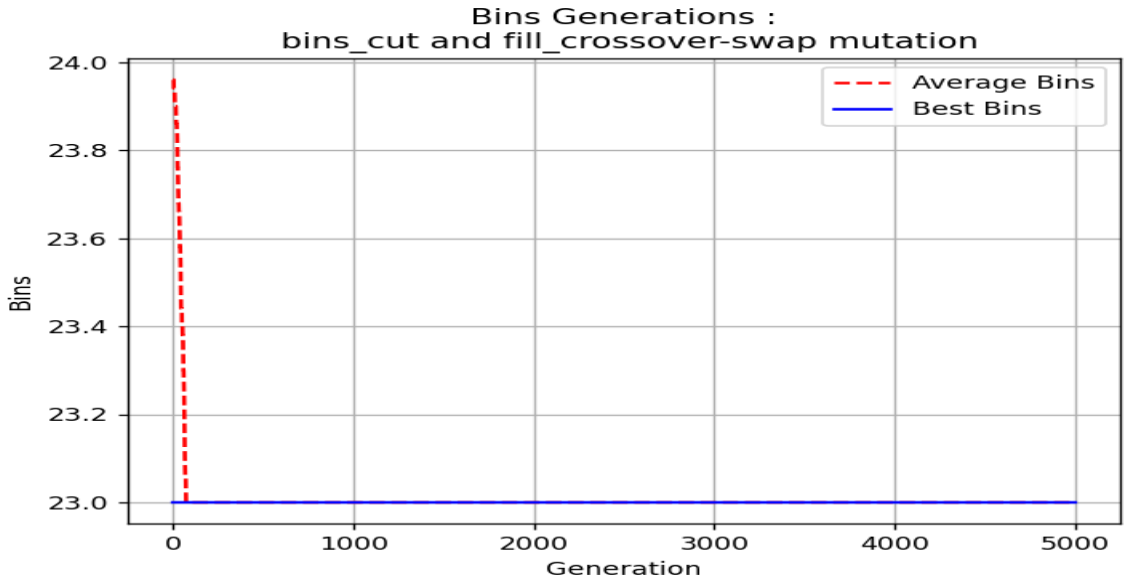



Bins Generations :
bins_cut and fill_crossover-swap mutation
Average Bins
Best Bins
Bins
23.8
23.6
23.4
23.2
23.0
0
1000
2000
3000
4000
5000
Generation

Instance 5: cut and fill crossover and swap mutation with max round 50






Bins Generations :
bins_cut and fill_crossover-swap mutation
Average Bins
Best Bins
Bins
Generation
24.0
23.8
23.6
23.4
23.2
23.0
0
1000
2000
3000
4000
5000